would read data sequentially from the magnetic tape 4. To access data randomly from the magnetic tape 4, the host application 22 could send the SCSI SPACE and LOCATE commands to the tape drive 10 to request a data record at an offset from the last record read from the magnetic tape 4. The host application 22 would use the SPACE command to instruct the tape drive 10 to set a new logical position relative to the current logical position, which is determined from the last data record returned by the tape drive 10. The SPACE command specifies a count field indicating the number of blocks (or filemarks) to move forward (if positive) or backward (if negative). The host application 22 would use the LOCATE command to instruct the tape drive 10 to position the magnetic tape 4 to the specified logical element at the specified position.

[0023] FIG. 4 illustrates further details of the data structures in the cartridge memory 6, including initialization data indicating the longitudinal position of all the logical points, including LP1, LP2, LP3, LP4, LP3', LP4', LP5, LP6, and LP7. The tape drive controller 12 would use the initialization data 70 to determine the start and end of each of the user data sections 50 and 52. The cartridge memory 6 further includes a table directory 72 that includes entries for each of the wrap sections. As discussed, in implementations where there are two separate user data sections 50 and 52, the 96 possible wrap sections would be divided between these two user data sections. Thus, each wrap in the user data sections 50 and 52 would comprise a wrap section. For each of the wrap sections listed in the table directory 72, the wrap section entry may specify:

Data Set ID: specifies the Data Set Identity of the last Data Set written in this wrap section. If this wrap section does not contain valid Data Sets, then this field shall be set to (0xFFFFFFFF).

Record Count: If this Wrap Section is valid, this field shall contain the number of Records that are started in the current Wrap Section. If the Data Set ID of this Wrap Section is (0xFFFFFFFF) and hence this Wrap Section is invalid, the Record Count field is not defined for interchange.

File Mark Count: If this Wrap Section is valid, this field shall contain the number of File

Marks that are within the current Wrap Section. If the Data Set ID of this Wrap Section is (0xFFFFFFFF) and hence this Wrap Section is invalid, the File Mark Count field is not defined for interchange.

CRC: This field shall specify the CRC generated for the wrap section data in the table directory 72.

[0026] In one implementation, the prior art LTO tape layout format of FIG. 1 may be modified to format the tape layout format of the described implementations of FIG. 3. For such implementations, to define the second user data section 52, LP3' may be set to a fixed value, such as 0.50 meters beyond LP4 so long as LP3' is less than LP5. The LP5 point in the prior art LTO Ultrium format (FIG. 1) then becomes LP4', and LP3 to LP5 can be 580 meters on a Type A LTO cartridge. Thus, if LP4 is set to LP3 plus 79.5 meters, then LP3 plus 79.5 meters plus 0.5 meters equals LP3 plus 80 meters. This provides two user data sections, one of 79.5 meters and the other of 500 meters, with a 0.5 meter section 54 (FIG. 3) separating the two user data sections 50 and 52. A third user data section would require that the length of LP4' is less than LP5 to allow the definition of LP3" and LP4" for the third user data section between LP3 and LP5.

[0031] FIG. 7 illustrates an additional serpentine pattern implementation that minimizes the distance to seek when writing data to the 49th wrap section (wrap section 48). In the serpentine pattern of FIG. 7, the tape drive writes in a serpentine pattern, alternating in the forward and backward direction between LP3 and LP4 for the first 47 wrap sections, e.g., wrap sections 0 through 46, which is the same pattern in FIG. 6 for the first 47 wrap sections. However, the pattern of FIG. 7 differs from FIG. 6 in that upon reaching the end of the 47th wrap section (the end of wrap section 46), the tape drive moves from LP4 to LP3' and then starts writing in a serpentine pattern, alternating between the forward and backward direction between LP3' and LP4' in the second user data section 52. This alternating pattern continues from wrap sections 47 through 94. There is a last possible wrap section 95, which can be written in the backward direction in the first user data

section 52 from LP4 to LP3. This last wrap section 95 may not be usable in certain implementations where shingled writing is used and where the first data section is to be written second. Thus in certain implementations, the last possible wrap section 95 may not be used.

[0032] The serpentine pattern of FIG. 7 improves the write performance when writing to wrap sections between the first 50 and second 52 user data sections by avoiding the need to seek from LP3 to LP3' when starting to write wrap section 47 at the beginning of the second user data section 52. Instead, with the serpentine pattern of FIG. 7, the tape drive needs only seek 0.5 meters when moving from the end of the first user data section 50 to the beginning of the second user data section 52. This is a performance improvement over the serpentine pattern of FIG. 6, which requires that the tape drive seek 80 meters when moving from the end of the first user data section 50 to the beginning of the second user data section 52.

[0033] Because the second user data section 52 is at a length of tape that is beyond the first user data section 50, the seek time from the beginning of the tape takes longer. Because the user data section 50 is shorter than is the user data section 52, the average seek time from one point in user data section 50 to another in user data section 50 is shorter than from one point in user data section 52 to another point in user data section 52. Thus, from the beginning of the tape or for movements within a wrap section, the first user data section 50 is faster than the second section 52 because the second section 52 follows the first section 50, and the first section is shorter. Accordingly, data that is more frequently accessed could be placed in the faster access first user data section 50.

In the Abstract:

Provided is a method, system, and program for storing data in a storage medium. A layout of a storage medium including a first and second user data sections is provided, wherein the first user data section comprises a faster access storage space than the second user data